CONFIDENTIAL

Office Memorandum • UNITED STATES GOVERNMENT

TO : Chief, Research & Development Laboratory DATE: 25 October 1956

FROM : Chief, External Projects Section

SUBJECT: Patents under Contract (RD)XG-578, Task Orders 2 and 5 with [redacted] 50X1

1. The Contracting Officer in a memorandum dated 4 October 1956 has asked if the Engineering Division wishes to protect its interests in inventions under the subject contract. The contractor has decided not to file patent applications.

2. It is requested that the Laboratory evaluate the two attached Abstract of Invention Disclosure reports and decide if the inventions are of sufficient importance to warrant the Agency taking steps to protect its interests in them.

[redacted] 50X1

Attachments:

1. Abstract on Plastic Convector
2. Abstract on Hydraulic Motor/Pump

CONFIDENTIAL

SECRET

ABSTRACT OF INVENTION DISCLOSURE RI-215

Brief Title: "Plastic Convector"

Inventor's Name (s): [redacted] 50X1

Project No. 3027 (Task 8) of Contract No.

Approximate date of Conception of Novel idea: 8 January 1953

Date of Preparation of the Abstract: 4 February 1954

1. Brief Abstract of what is accomplished by invention:

The problem of generating power from a thermopile consists of the need to maintain a temperature gradient from one end of the pile to the other. In its simplest terms, this means the heat must be supplied at one end of the pile and removed from the other end. Since the efficiency of the thermopile in converting heat to electrical energy is low, almost all of the heat supplied must be extracted and dissipated into the surrounding air. In general, the heat flow from source to sink may be divided into three steps: (a) heat flow from fuel to hot junctions; (b) heat flow from hot junctions to cold junctions; (c) heat flow from cold junctions to surrounding air. The principal parts of a thermoelectric generator consist of the firebox, the thermopile and the heat dissipating unit. In a typical generating unit designed to produce a 10-ampere charging rate, the fuel rate may be specified to be 20,000 BTU per hour, the temperature of the hot junctions of the thermopile 550° F., and the temperature of the surrounding air may be 100° F.

This invention is concerned with a novel type of unit for dissipating heat. Such a unit is useful in connection with a thermoelectric generator as described above, in which a fairly large amount of heat is produced by the combustion of fuel, is subsequently conducted through a thermopile, and must then be dissipated in the surrounding air. The progression of heat through the unit will travel from a heated surface through the thermopile by conduction, into a volume of boiling water, and will then appear as the latent heat of vaporization of the resulting steam; the steam will then be condensed on some closed surface, cooled by the air, and the moisture returned to the boiler as a condensate.

If the additional requirements are made that such a thermoelectric generator must be limited in weight, portable, and easily collapsible, it is apparent that the large amount of surface area required to cool and condense the steam will require a convector of some considerable size. It is therefore desirable to use a light, collapsible material for the convector, shaped in such a way as to form a large cooling area, at the same time being both sturdy and efficient.

It has been found that hollow vertical tubes of plastic, connected top and bottom in an annular array as shown in the accompanying Figure 1, function very well. The plastic convector therefore comprises a matrix of equally spaced tubes in a concentric ring formation. Annular tubes are attached at top and bottom, conducting the steam out to the convecting area.

In Figure 2, a cutaway view of the convector is shown. The matrix of tubes has been sliced vertically down the middle, revealing the sloping drain pan which collects condensed moisture from the vertical tubes and channels it back to the boiler below (shown in Figure 1). The pan is equipped with numerous holes in its sides, shown in Figures 2A and 2B, to which are attached annular drain pipes from the outer rings of vertical tubes.

FORM [redacted] 50X1

ABSTRACT OF INVENTION DISCLOSURE

Brief Title: "Plastic Convector"

Inventor's Name (s): [redacted] 50X1

1. Brief abstract of what is accomplished by invention:

It is obvious that shapes for the convector matrix, other than annular, could be devised; the array of tubes might take a rectangular, triangular, or even irregular shape. However, it was convenient to design a convector using tubes 1" in diameter and 0.002" thick, grouped in 6 rings containing 37, 31, 25, 18, 12, and 6 tubes respectively; a single tube occupies the center of the matrix. Tubes are 1" apart and the rings are also separated by 1". Vertical tubes are 2½' long, and the entire array is 25" in diameter.

The boiler and firebox assembly is shown as an exploded view in Figure 3. A typical firebox may have a volume of 0.75 cu. ft. and an area of 4 sq. ft., measuring 18" x 12" x 6" overall. The heating area is the area in contact with the fluid being heated on one side and the hot gas resulting from combustion on the other side. The firebox side-walls, which will be subjected both to gas erosion and to temperatures close to the melting point of aluminum, are formed of #310 stainless steel 0.02" thick, plated with a layer of copper which varies from 0 thickness at the bottom to 0.04" at the top of the firebox. The walls are covered with glass wool insulation 1" thick, and the insulated firebox is encased with aluminum 1/32" thick. A grate fabricated of stainless steel is provided with an ash pit 3" deep below it. The feed-door is designed to be close fitting, insuring positive control with the primary and secondary drafts.

Usually the most difficult problem in the design of a thermoelectric unit is that of the cooling system. If a unit of this type is to be capable of discharging approximately 10,000 BTU per hour (assuming that half the 20,000 BTU produced by fuel combustion is lost through the smokestack), and the air surrounding it is at 100° F., it would be difficult to keep the generator within the limits of portability and also to satisfy the specification for an inconspicuous, self-contained unit. If water cannot be supplied continuously to the system, a convecting area large enough to dissipate 10,000 BTU/hr. by free convection must be devised; hence the suggestion herein for a collapsible plastic bag, fashioned as a matrix of plastic tubing in order to concentrate the large required area into as compact a unit as possible. If fabricated of tubing 1" in diameter and 0.003" thick, the convector itself will weigh approximately 2 lbs.

Figure 3 shows the thermopile in position. The layout of the various thermoelectric elements is more clearly shown in Figure 4, which illustrates how the thermopile may be composed of a zigzag array of thermoelectric elements all fashioned in the form of small cylinders. The entire array of thermoelectric elements is held and supported by a jig consisting of 2 sheets of heat-resistant glass-plastic laminate having drilled holes to maintain the elements at the proper spacing. The thermopile described is specified to have an internal resistance not exceeding 0.2 ohm. The thermonegative element used here is "constantan" (60% Cu, 40% Ni), and the thermopositive element is "alloy 1083" (42 parts Zn, 58 parts Sb, 2 parts Sn). Junctions are formed by connection through copper busses.

The material which is suggested for the flexible convector is known as "Trithene type B" which is manufactured by the Visking Corp., Terra Haute, Indiana. This material is chemically known as polytrifluoromonochlorethylene, and can withstand

ABSTRACT OF INVENTION DISCLOSURE

Brief Title: "Plastic Convector"

Inventor's Name (s): [redacted] 50X1

1. Brief abstract of what is accomplished by invention:

a temperature of 300° F. continuously. Since the unit is flexible, it would need to be supported from the top by a wire framework.

Brief Title: "Plastic Convector"

Inventor's Name (s): [redacted] 50X1

2. Brief Summary of advantages of this idea over what has been done before:

The material selected for use above can be readily welded or bonded to itself and other surfaces, and has a high degree of strength. Being flexible, it may be collapsed so as to occupy a very small space, and its lightness lowers the weight of the portable generating unit of which it is a part. It withstands high temperatures without damage. In case the generated steam increases, the pressure inside the convector would in turn increase, therefore filling more of the tubes and increasing the effective cooling area and cooling rate of the convector. Other materials, such as vinyl or teflon, might also be used in case trichene is not available.

3. Brief Summary of what is new here:

The normal means of conveying heat from a thermoelectric generator usually involves a fairly heavy metal apparatus or radiating fins which cannot be conveniently made portable, light-weight, or collapsible. So far as is known, the construction and use of a plastic material for a convector of this type is novel.

50X1

4. Pertinent References to notebooks, publications, and other written matter:

50X1

Read and understood by me this date

Attach whatever drawings or other sheets are necessary to graphically complete the description of the above idea. All addendum sheets must be signed, witnessed and dated.

FORM [redacted] 50X1

FIG. 1

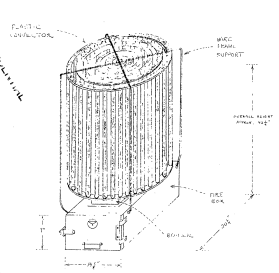


FIG. 2

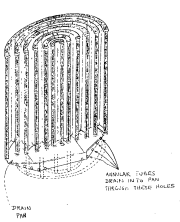


FIG. 2A

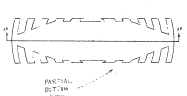
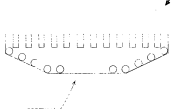


FIG. 2B



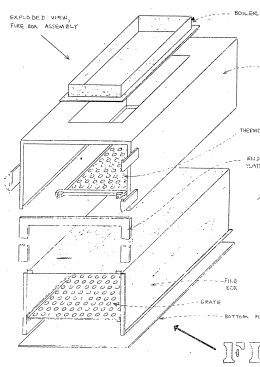
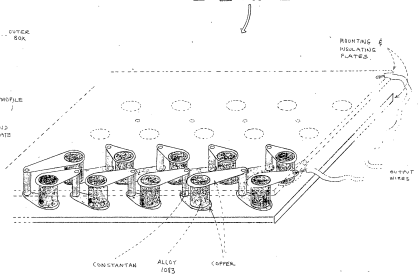


FIG. 3

FIG. 4



CONFIDENTIAL

XV-83301